Assessing the effects of human disturbance using ground-dwelling arthropods: does sampling method affect our conclusions?

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INTRODUCTION

- **Pitfall traps** are a very popular way of sampling ground dwelling invertebrates for ecology studies. They are cheap, can be left working for several weeks and collect high numbers of individuals.
- **Berlese-Tullgren** funnels (Berlese) extract most mobile individuals found in a known volume of litter or soil sample.
- However, sampling accuracy is affected by many factors, including climate and habitat structure for pitfalls, sample volume and funnel characteristics for Berlese and species mobility and behaviour for both methods (Southwood & Anderson 2000).
- Can both sampling methods obtain similar results in ecology-focused studies?

OBJECTIVES

Do pitfall- and Berlese-sampled data obtain similar patterns of ground-dwelling spider, staphylinid and carabid assemblages in managed boreal forests? Specifically:

- Do responses of arthropods to canopy cover type and forestry management in overall abundance, alpha diversity and species composition differ between sampling methods?
- Do both methods rank species relative abundance similarly?
- Do they collect the same species?

METHODS

The study was carried out in Canadian boreal mixedwood. A fully replicated 3x2 design was used:

- Three cover types: deciduous-dominated (DD), mixed (MX) and coniferous-dominated (CD)
- Two forestry stages: mature and regenerating (11 years after clear-cutting)

Three replicates of each cover type x forestry stage combination were sampled:

- Three pitfall traps 50-m apart were placed in each replicate for 12 weeks in summer.
- Litter samples were collected three times near each pitfall trap.

The effect of cover type and forestry stage on overall abundance, alpha diversity and species composition was tested with PERMANOVA and 9999 permutations.

Fig. 1. Sampling sites and methods: a) coniferous-dominated mature stand; b) regenerating stand; c) pitfall trap showing captures; d) soil sample to be processed in e) Berlese-Tullgren funnel.

RESULTS

Table 1. Summary of significant results on the effect of cover type and forestry stage on overall abundance, alpha diversity and species composition of the groups studied.

Attribute	Group	Pitfall	Berlese	Agree?	Fig. #
Abundance					
	Spiders	mature < regenerating	mature > regenerating	✗	2a
	Staphylinids	mature < regenerating	no differences	✗	2b
Diversity					
	Spiders	mature < regenerating	mature > regenerating	✗	2c
	Carabids	deciduous < coniferous	no differences	✗	2d
Composition					
	Spiders	mature ≠ regenerating	mature ≠ regenerating	✓	
	Staphylinids	mature ≠ regenerating	mature ≠ regenerating	✓	
	Staphylinids	deciduous ≠ coniferous	no differences	✗	

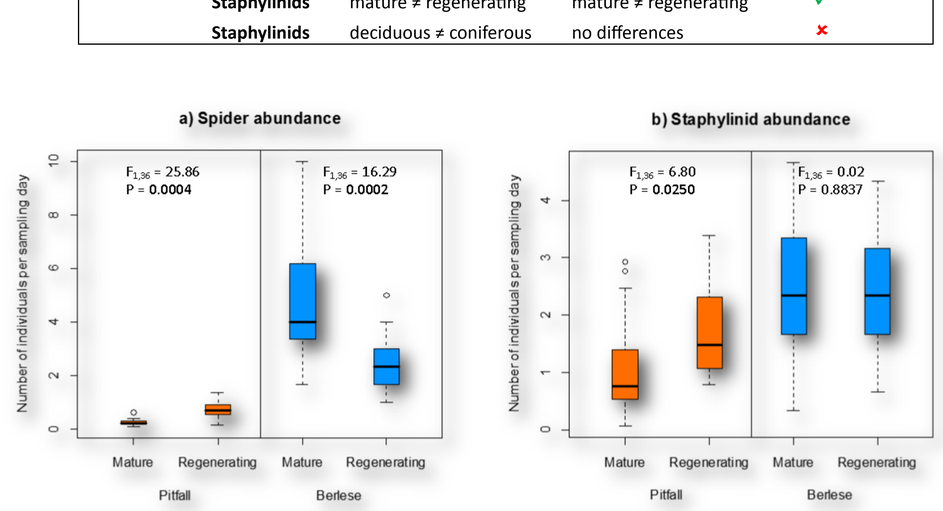

Fig. 2. Overall abundance per day (a, b) and arthropod alpha diversity (c, d) plots comparing significant results obtained with pitfall and those obtained with Berlese.

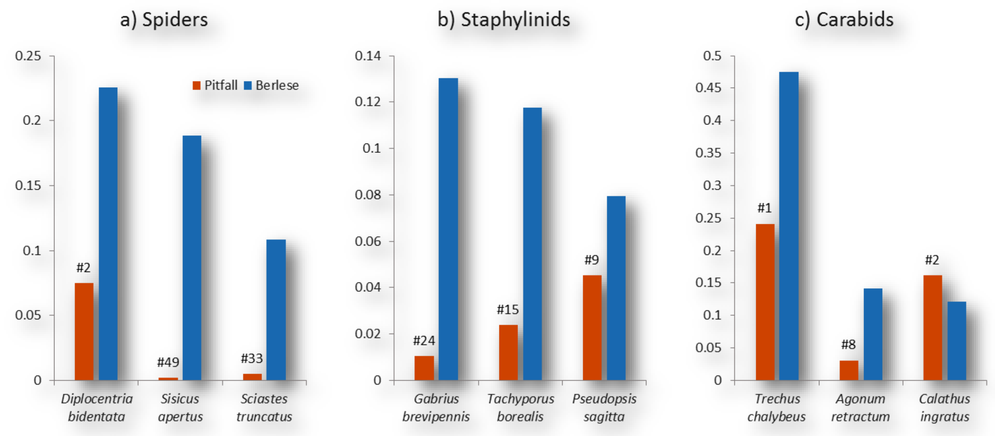

Fig. 3. Relative abundance of the three most common species sampled with Berlese and their corresponding relative abundance in pitfall traps.

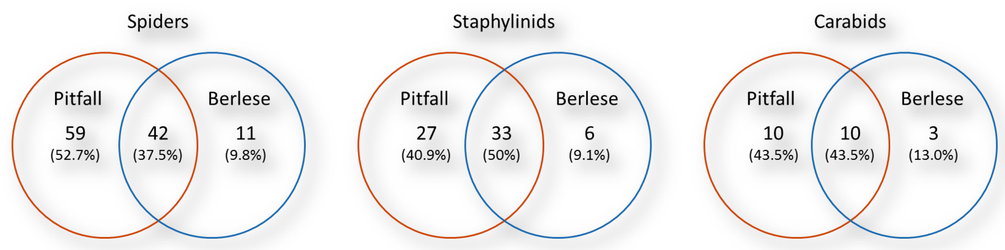

Fig. 4. Number (and %) of species found with each sampling method.

CONCLUSIONS

- Pitfall and Berlese methods obtained different results on the effect of forestry management on arthropod abundance and diversity. Results were more similar for species composition analyses.
- Relative abundance differed widely between methods except for carabids. Behaviour may affect catchability: highly mobile surface dwellers may be easily captured with pitfall traps and low mobile species may be better detected with Berlese.
- Pitfall traps collected most species, but some were only found with Berlese. Both methods are complementary for biodiversity surveys.
- Sampling method bias should be acknowledged when interpreting ecological results.

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References

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